

Exploring the potential of ICESat-2 data for fuels characterization

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We define applications as innovative uses of mission data products in decision-making activities for societal benefit

What do we mean by applications?



**Enhance Applications Research | Increase
Collaboration | Accelerate Applications**

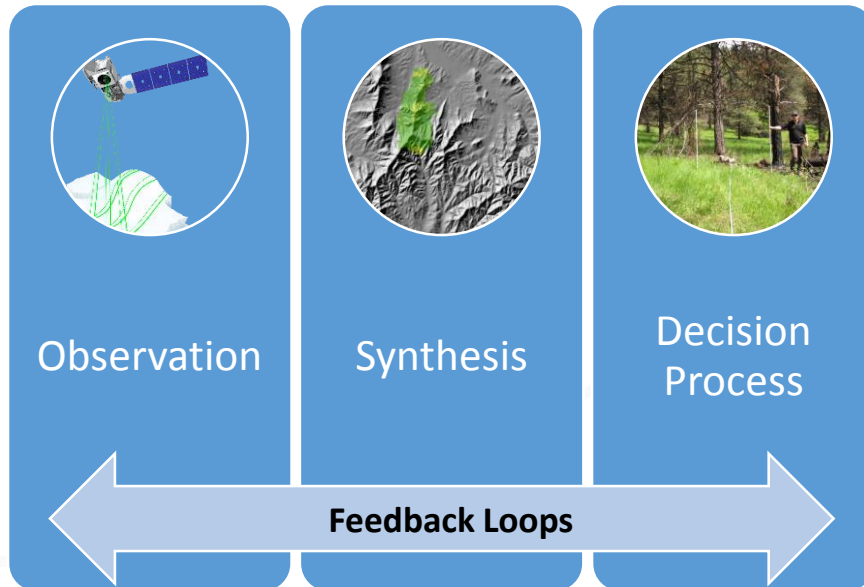
- How can data be used effectively within analyses, forecasts, and models so as to improve decision processes needed to address practical societal needs?
- What is the scientific information flow for different applications starting from observation to end-use? Who is involved?
- How can the expected observations be leveraged or complemented with other data sources so as to lead to improved data products?

Early Adopter Program

What are Early Adopters?

Early Adopters are defined as those groups and individuals who have a direct or clearly defined need for upcoming data products, have an existing application or decision making activity, and who are planning to apply their own resources (funding, personnel, facilities, etc.) to demonstrate the utility of new data for their particular application.

Why Early Adopters?



- To accelerate the use of data after launch via pre-launch research.
- To gain insights into potential benefit of new observations to society
- Allow for valuable feedback on how data can be used for decision support and integrated into sustained services

How does the Early Adopter Program work?

- Early Adopters are solicited via **informal calls** (applications are now accepted and reviewed on a rolling basis)
- Self-nominations are accepted!
- Early Adopter will be **partnered with a Science Definition Team member or project science member** who is developing or knowledgeable of a product that the EA proposes to use.
- The Science Team member will gain a partner who can evaluate products and offer **feedback from a utility perspective** as well as potential calibration and validation information.
- The Early Adopter program is a **volunteer effort** from both the EA and SDT.

Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) Early Adopter Program

The Application of Altimetry Data for the Operational Water Level Monitoring of Lakes and Reservoirs for USDA/FAS
PI: Dr. Charon Birkett, ESSIC/UMD

End User: USDA/FAS (POC: Dr. Curt Reynolds, Office of Global Analysis)
Requested SDT Partner: Mike Jasinski, NASA/GSFC

ABSTRACT

NASA and USDA/FAS are currently funding a near real time operational program which monitors lake and reservoir water levels. The input is currently satellite-based radar altimetry data sets (NASA/CNES Topex/Poseidon, Jason-1, Jason-2, ERS, ENVISAT, SARAL). In a qualitative sense USDA/FAS utilize the water level products for observation of (a) long term lake level status, for assessment of hydrological drought, (b) near real time lake level status, for assessment of agricultural drought, and (c) near real time lake level status for detection of high water (flood) levels. Both (b) and (c) have potential impact on crop condition and production. ICESAT-2 products would potentially be utilized in two ways, (i) as a primary data source and the operational monitoring of high latitude reservoirs. This assumes a fast delivery of data products with (at least) monthly temporal sampling, (ii) as a secondary (archive) data source for the validation of radar altimetric derived water level products for lakes and reservoirs at all latitudes.

Integration and assessment (both (i) and (ii)) of ICESat-2 products assumes continued funding of the program by NASA and/or USDA and/or additional future stakeholders. USDA/FAS currently utilize water level products in a qualitative, not quantitative sense – there is no direct assimilation of ICESat-2 data into their DSS. However, elevation products are an additional tool within an array of model and remote sensing products that are utilized in a monthly USDA/FAS ‘lock-up’ process which inputs model/remote sensed data and outputs global crop statistics, advisories and warnings.

The methods of using ICESat-2 data will follow standard altimetric repeat track techniques, noting additional benefits provided by ICESat-2 data with respect to improved elevation accuracy, improved spatial sampling, and a potential ability to monitor surface levels during freeze-periods (which is currently excluded within the radar altimetry data sets).

Nominees provide a short abstract and elaborate on the project with a clear description of the end-user and expected impact to decision process.

ICESat-2 now has 19 Early Adopters

No. EAs	Science Theme	SDT/Project Office Partner	Potential Applications
1*	Atmospheric Sciences	Steve Palm	Climate; Air quality (effects on health and environment); Volcanic Hazards
5	Hydrology	Mike Jasinski	Hydrological drought; agricultural drought; monitoring of high water (flood) levels; monitoring of crop condition and production. Prediction and managing of flood disaster impacts and global flood risk. Water resource management; observation of freshwater storage change. Reservoir Management; Operational lake bathymetry
2	Ice Sheets; Solid Earth	Alex Gardner	Sea level rise monitoring/forecasting; Volcanic hazard mitigation, monitoring, and forecasting.
4	Sea Ice	Sinead L. Farrell, Ron Kwok	Navigation; Arctic shipping; Operational ice charts; coastal deliveries; monitoring habitat of marine wildlife; offshore oil and gas industry roads; travel/transportation; Sea ice forecasting; national defense environmental forecasting; coordinated disaster response: oil spill mitigation, field campaigns; improved climate projections at all latitudes; Climate data records; weather hazards; prevention/mitigation of atmospheric catastrophes
1	Sea Ice & Ice Sheets	Tom Neumann	Commercial fishing and offshore oil; Operational use by Alaska forecasters
6	Vegetation	Amy Neuenschwander, Sorin Popescu	Long-term land management. Use estimates of aboveground biomass to quantify carbon, fuel loads, and monitor change in semiarid regions; Monitor forest-related harvesting and land use; Forest inventories and fire fuel mapping; Wildfire decisions; fire behavior modeling variables; Land Management and monitoring over large regions (Arctic Tundra, Boreal Forest); Forest mapping and monitoring.

ICESat-2 Vegetation Early Adopters

Early Adopter	Research Title	End-User(s)	Applications
<ul style="list-style-type: none"> • Birgit Peterson, USGS Earth Resources Observation and Science Center; • SDT/Project Office Partner: Amy Neuenschwander 	Evaluation of ICESat-2 ATLAS data for wildland fuels assessments	<ul style="list-style-type: none"> • U.S. Forest Service's Wildland Fire Assessment System (POC W. Matt Jolly, mjolly@fs.fed.us, Project Manager) 	Wildfire decisions; fire behavior modeling variables
<ul style="list-style-type: none"> • G. Javier Fochesatto, Geophysical Institute University of Alaska Fairbanks • Falk Huettmann, Institute of Arctic Biology, University of Alaska Fairbanks • SDT/Project Office Partner: Lori Magruder 	Using ICESat-2 prelaunch data in high latitude terrestrial ecosystems to allow for continuous monitoring of boreal forests and Arctic tundra	<ul style="list-style-type: none"> • USDA Forest Service PNW Research Station (POC: Dr. Hans-Erik Andersen) 	Land Management and monitoring over large regions (Arctic Tundra, Boreal Forest)
<ul style="list-style-type: none"> • Lynn Abbott, Virginia Polytechnic Institute and State University • SDT/Project Office Partner: Sorin Popescu 	Detection of ground and top of canopy using simulated ICESat-2 lidar data	<ul style="list-style-type: none"> • American Forest Management, POC: John Welker; • USDA Forest Service, POC: John Coulston 	Monitor forest-related harvesting and land use

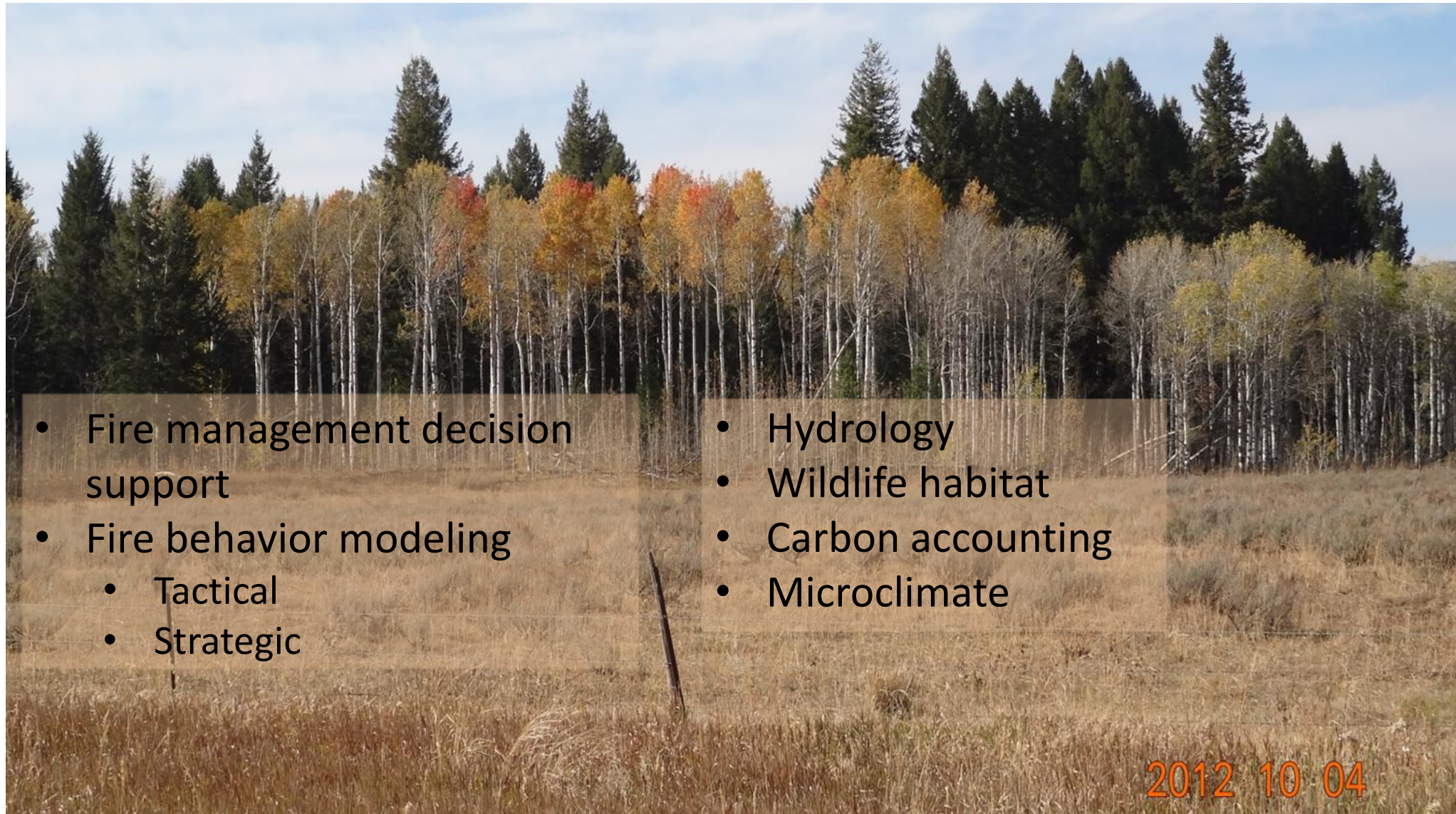
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ICESat-2 Vegetation Early Adopters

Early Adopter	Research Title	End-User(s)	Applications
<ul style="list-style-type: none"> • Nancy Glenn, Boise Center Aerospace Laboratory (BCAL) • SDT/Project Office Partner: Amy Neuenschwander 	Improved Terrestrial Carbon Estimates with Semiarid Ecosystem Structure	<ul style="list-style-type: none"> • USDA (US Forest Service and Agricultural Research Service, POC Dr. Stuart Hardegree) • DOI (BLM, POC: Anne Halford; including the Great Basin Landscape Conservation Cooperative (LCC), and USGS, POC: Dr. Matt Germino) • DoD (Charles BaunIdaho Army National Guard) • Regional partners (Great Basin Research and Management Partnership and Joint Fire Sciences Program) 	Long-term land management. Use estimates of aboveground biomass to quantify carbon, fuel loads, and monitor change in semiarid regions.
<ul style="list-style-type: none"> • Subrata Nandy, Indian Institute of Remote Sensing, Indian Space Research Organization • SDT/Project Office Partner: Sorin Popescu 	Forest carbon stock assessment and monitoring: A study in Indian tropical forest using ICESat-2 data	<ul style="list-style-type: none"> • Forest Department, Government of Assam, India (POC: Parshant Dhanda, IFS, Divisional Officer) 	Forest mapping and monitoring.
<ul style="list-style-type: none"> • Wenge Ni-Meister, Hunter College, The City University of New York • SDT/Project Office Partner: Sorin Popescu 	Mapping Vegetation with On-Demand Fusion of Remote Sensing Data for Potential Use of U.S. Forest Service Inventories and Fire Fuel Estimates	<ul style="list-style-type: none"> • U.S. Forest Service 	Forest inventories and fire fuel mapping

High-quality canopy structure and fuel maps are necessary for a variety of applications



- Fire management decision support
- Fire behavior modeling
 - Tactical
 - Strategic

- Hydrology
- Wildlife habitat
- Carbon accounting
- Microclimate

2012 10 04

A brief introduction to LANDFIRE

- Multi-agency partnership
- Operational program
- Detailed information at www.landfire.gov

Objectives

- A national assessment of vegetation, fuel, and ecosystem conditions
- Implementation of national wildland fire policies

24 primary data products

- Vegetation types and structure
- Surface and canopy fuels
- Fire regime conditions

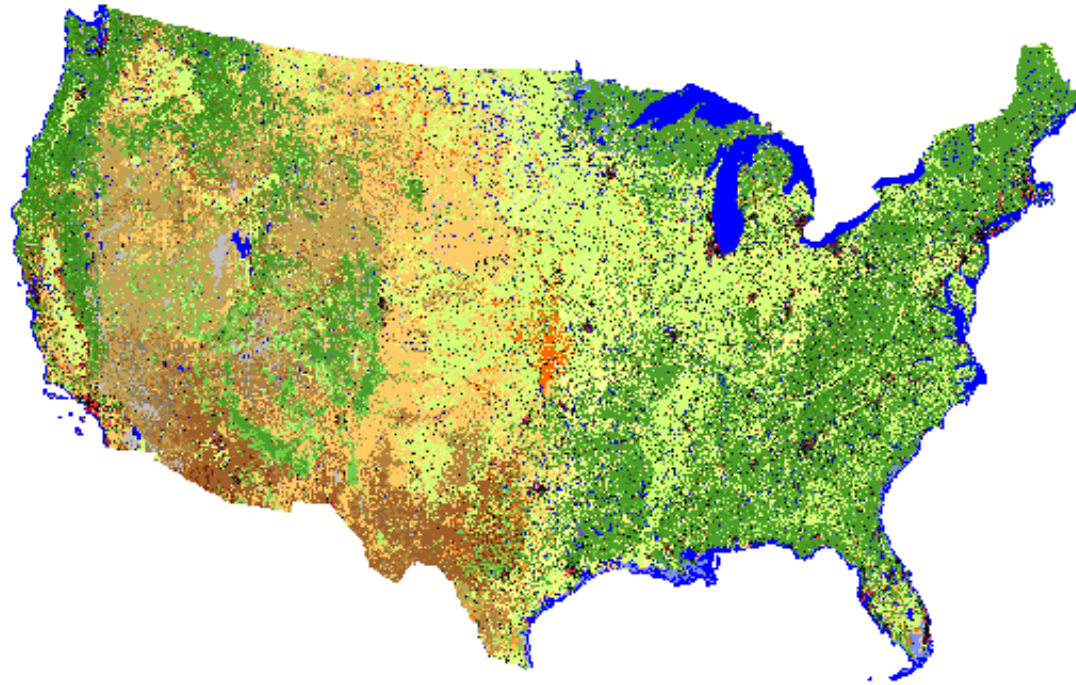
Intended applications

- Fire hazards
- Fuel reduction
- Incident planning
- National strategic planning
- Ecosystem restoration

























Updating strategies

- Initial mapping and updating
- Planned remap effort

LANDFIRE Existing Vegetation Height

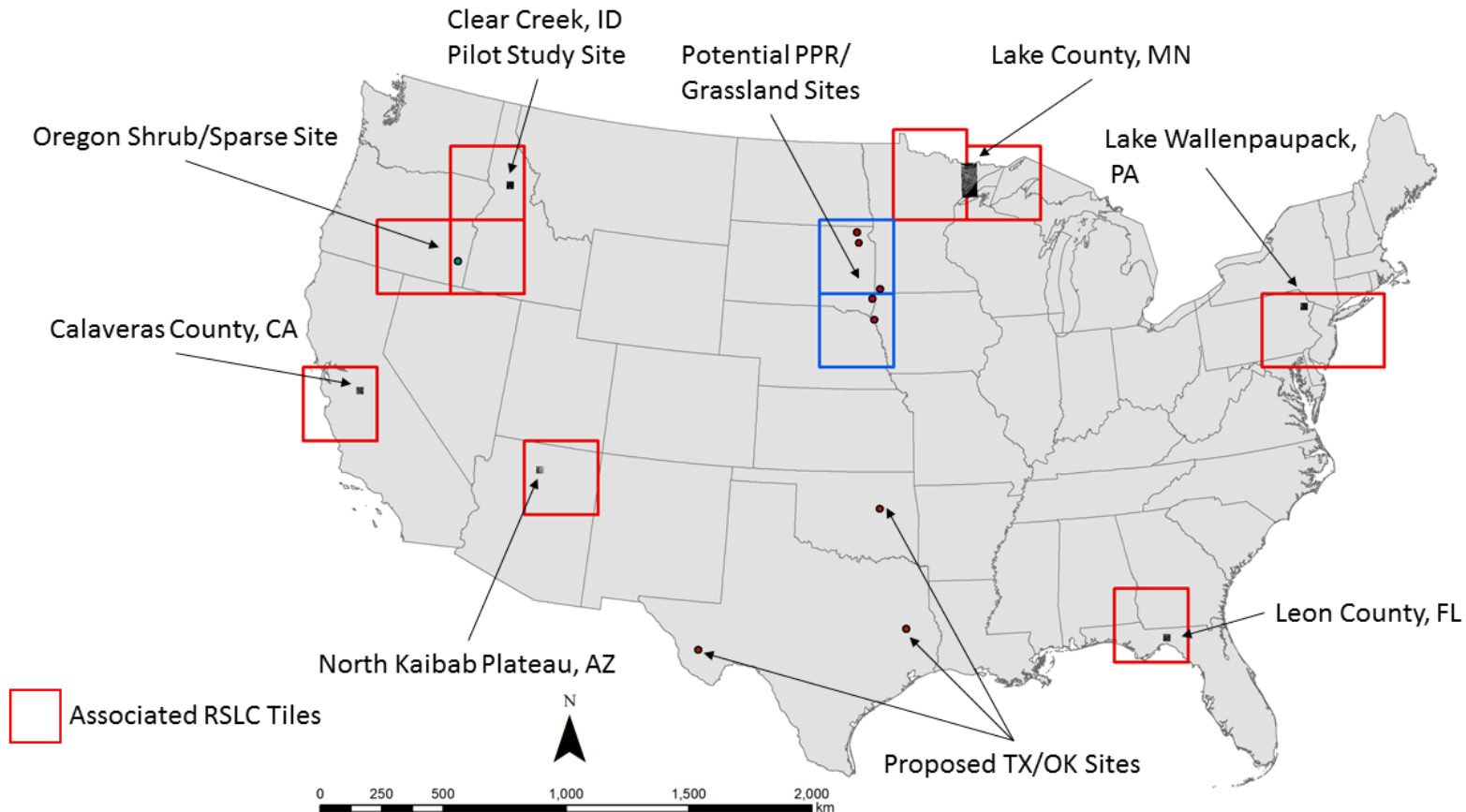


LANDFIRE EVH Classes

 Open Water	 Forest Height 0 to 5 m	 NASS-Bush fruit and berries
 Barren	 Forest Height 10 to 25 m	 Pasture/Hay
 Cultivated Crops	 Forest Height 25 to 50 m	 Recently Disturbed Forest
 Developed - High Intensity	 Forest Height 5 to 10 m	 Shrub Height 0 to 0.5 m
 Developed - Low Intensity	 Forest Height > 50 m	 Shrub Height 0.5 to 1.0 m
 Developed - Medium Intensity	 Herb Height 0 to 0.5 m	 Shrub Height 1.0 to 3.0 m
 Developed - Open Space	 Herb Height 0.5 to 1.0 m	 Shrub Height > 3.0 m
 Snow/Ice	 Herb Height > 1.0 m	 Sparse Vegetation Height

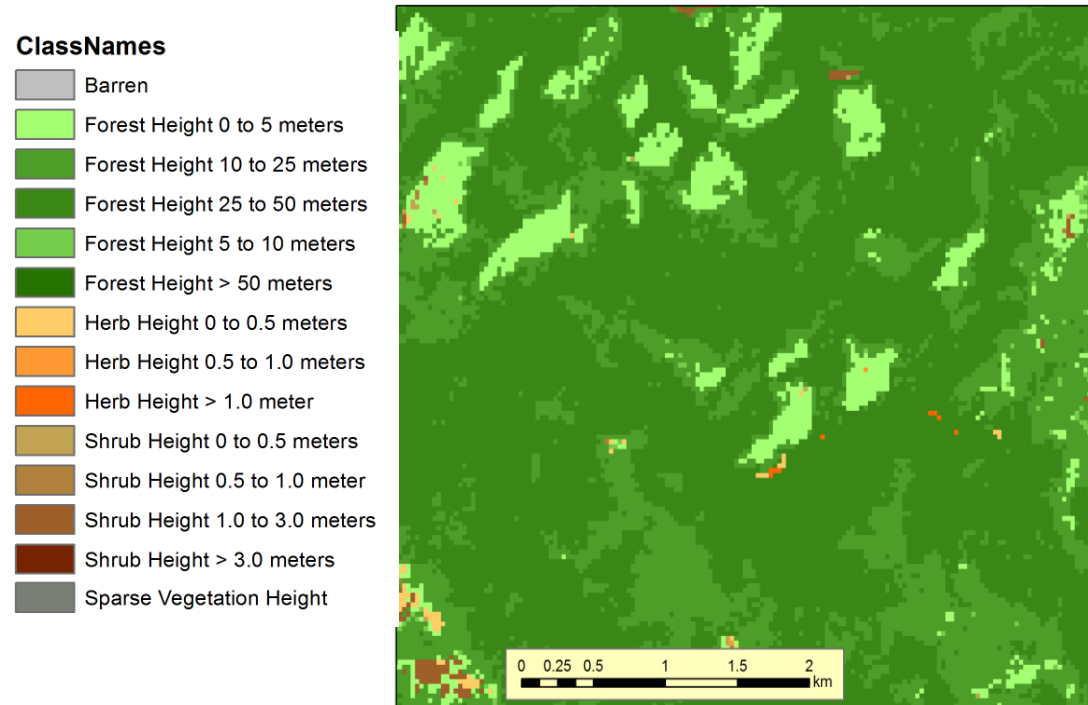
LANDFIRE Remap

- Generating whole new set of basemaps reflecting conditions ca. 2015
- Testing the incorporation of lidar data, ultimately hoping to include ATLAS data for future updates
- Set of study areas to explore new datasets and test new methodologies

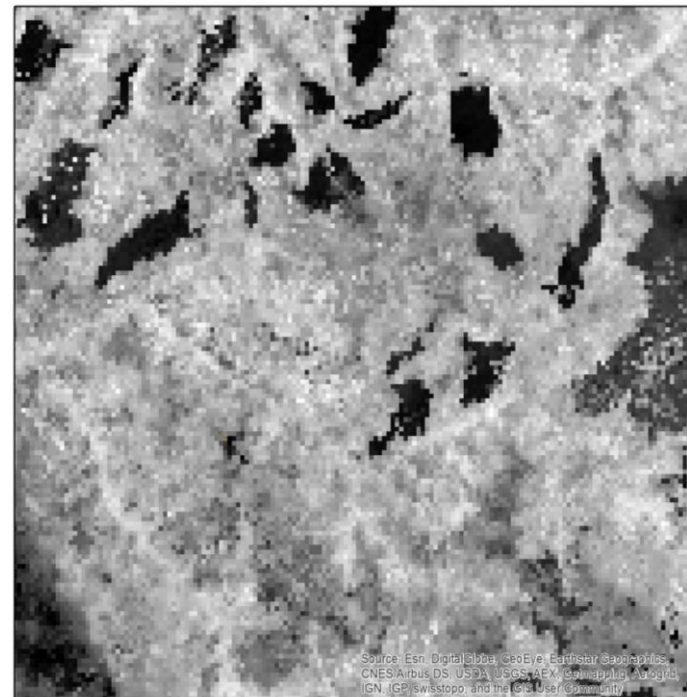


Characterizing structural heterogeneity

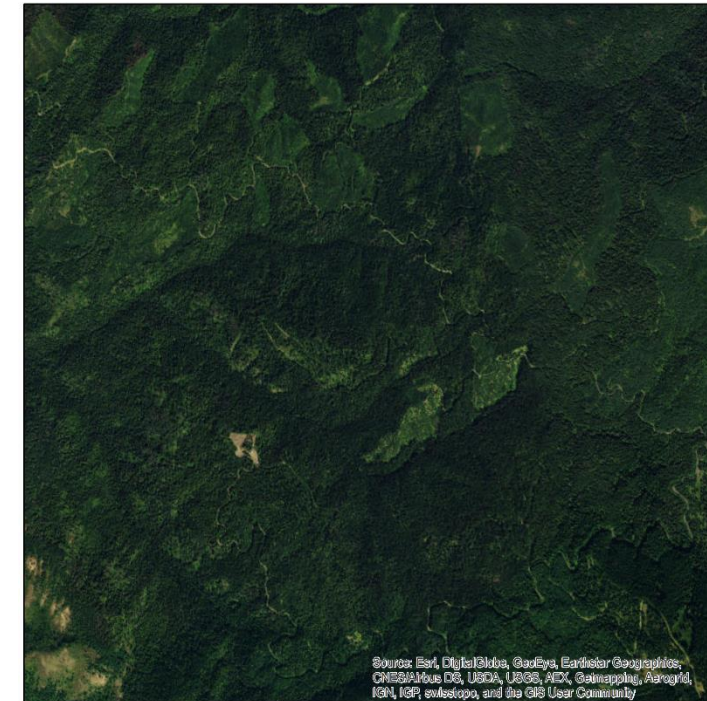
LANDFIRE EVH



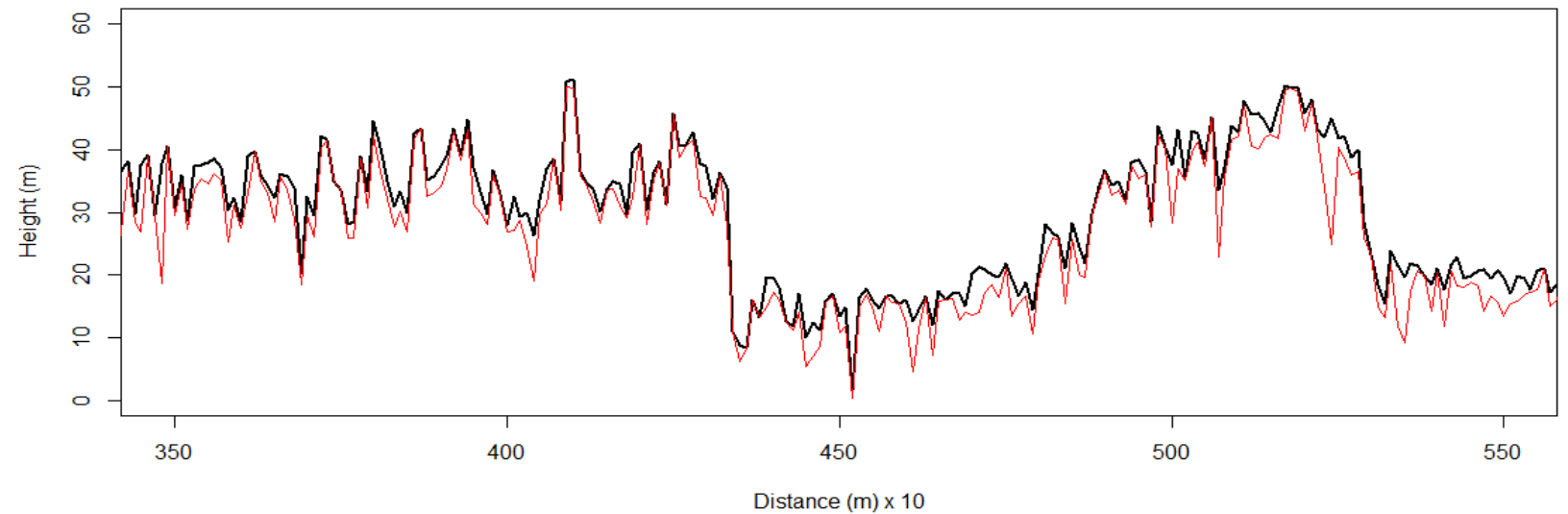
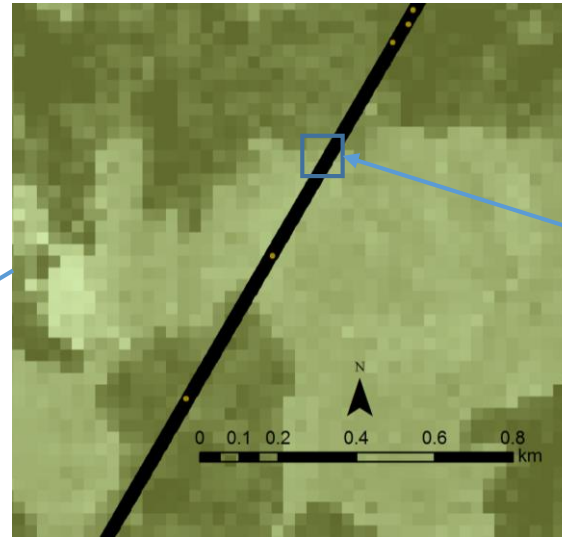
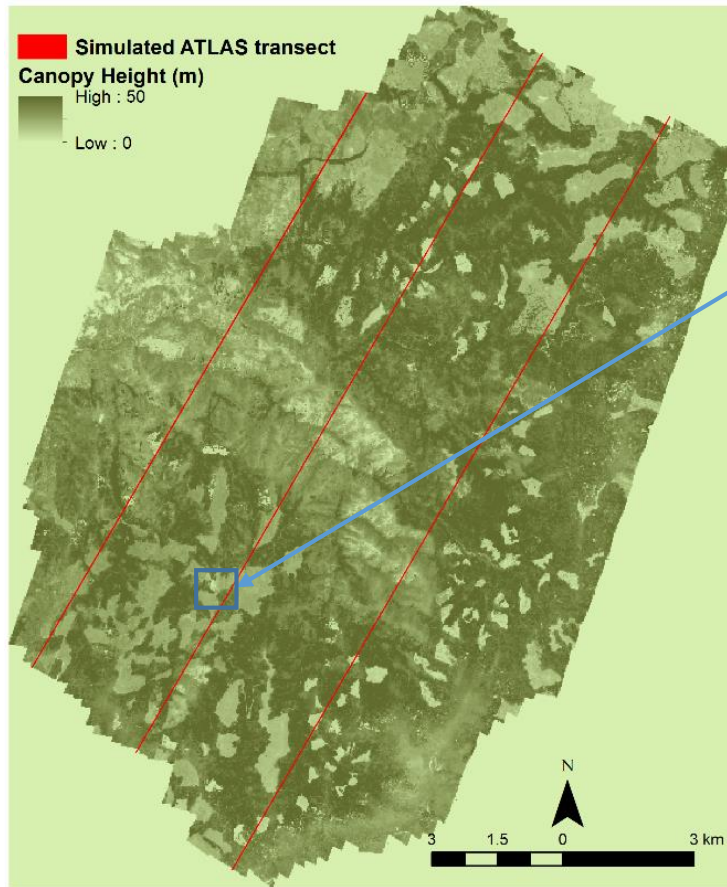
Lidar-Derived Height



High-Resolution Imagery



Characterizing structural heterogeneity

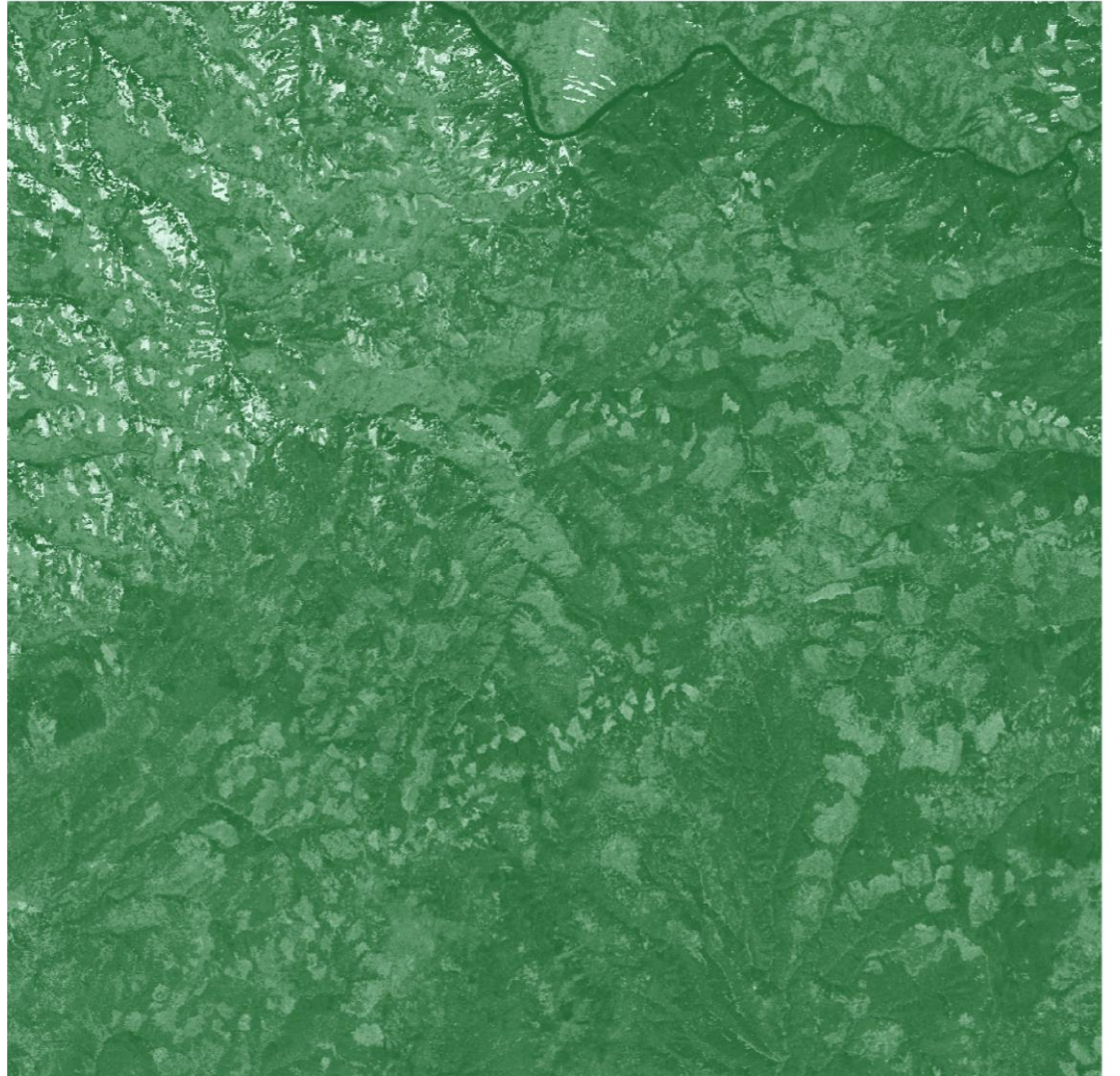


Mapping results

2015 L8 Image Composite, Day 171, with simulated lidar



Cubist-based predicted height



Continued research

- Continue with height modeling
 - Using MATLAS data – identify potential coincident study areas with LF Remap
- Test different extrapolation methods for generating spatially continuous products
- Explore use of data for deriving fuels-specific metrics
 - CBH
 - CBD

Take Away Messages

- Early engagement allows the Early Adopter and other potential users to better prepare for integrating the mission science data products in their systems/models/forecasts
- Three overarching goals:
 - Enhance applications research
 - Increase Collaboration
 - Accelerate applications
- Early Adopters provide key insights into critical needs for ICESat-2 like data and expected utility of ICESat-2 for specific applications.
- Having prelaunch research experience as an ICESat-2 Early Adopter allows for mutual feedback and guidance from the mission Science Definition Team (SDT)—saving on time and resources in the post launch.
- We welcome your nominations to the Early Adopter program! Next submission deadline: 28 February 2017 (*also accepted on a rolling basis)

Resources

- **ICESat-2 Mission Website:**
<http://icesat-2.gsfc.nasa.gov/>
- **ICESat-2 Applications Community Listserve:**
<https://lists.nasa.gov/mailman/listinfo/icesat-2-applications/>
- **ICESat-2 Early Adopters:**
http://icesat-2.gsfc.nasa.gov/early_adopters

Thank you!



Questions? Nominations to the Early Adopter Program?

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